



# COMMUNITY WIND TOOLKIT:

A Guide to Developing Wind Energy Projects in Alaska

Renewable Energy Alaska Project (REAP)  
March 2011

## Acknowledgements

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## **A Guide to Developing Wind Energy Projects in Alaska**

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### **EXECUTIVE SUMMARY**

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Wind-generated electrical energy is the world's fastest growing energy source. The advantages of producing power from the wind are numerous. Wind can be an abundant local resource. Wind is inexhaustible. Wind provides stable-priced power. Wind is often economically competitive with conventional energy sources. Because it is not imported, wind provides energy security.

Alaska is endowed with abundant wind resources. Deciding to develop local wind resources is an exciting step for any community or utility. However, it comes with numerous considerations and a significant need for planning, and not every community has a viable wind resource. Communities, utilities and developers interested in developing a wind project will need to know:

- How to determine if a developable wind resource exists
- How to determine an appropriate site for a wind project
- What feasibility studies need to be conducted
- What permits are involved in approving a site and constructing wind turbines
- How to finance a project
- What financial incentives exist for wind construction in Alaska
- What are the maintenance and operation requirements of wind turbines

This Guide intends to answer these questions and provide the tools needed to create a successful wind energy project. It is organized into 10 sections:

- I. Project Scope & Project Team
- II. Wind Resource & Site Selection
- III. Public Outreach & Community Involvement
- IV. Wind Power Feasibility Studies
- V. Permitting
- VI. Financing
- VII. System Design
- VIII. Construction & Interconnection
- IX. Operation & Maintenance
- X. Case Studies

Our hope is that this Guide will provide the basic background information needed to develop a wind project in Alaska and will direct people to the appropriate resources to find out additional information.

The following planning phases do not always proceed in the order indicated throughout this guide. However, the phases are here to provide guidance and to identify what can be expected when moving from the scoping phase through subsequent phases of a wind project.

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## I. PROJECT SCOPE & PROJECT TEAM

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Wind projects always start with a vision, whether it is to lower the cost of energy, reduce dependence on fossil fuels, or to utilize a local and renewable resource. When initiating a wind project, it is important to define the project scope and objectives early on. This allows the project to remain focused with clear objectives, to stay on track as it progresses, and to identify project gaps. A significant part of this process is to determine the specific electricity needs of the community in order to determine the desired size of the wind system, grid and diesel integration, and system costs.

One of the most important, but often overlooked, components of building a wind project is identifying a project champion. The success of most rural wind systems hinges on this individual's ability to leverage resources, use their influence to gather support, and provide the needed momentum for a project. This may involve advocating for a project, coordinating community meetings, discussing the project with local entities, connecting with permitting and funding agencies, and making sure the project is on task and moving forward according to the schedule. This individual may already be a local leader. However, they may also be a local resident that is interested in wind power or an individual affiliated with a local government entity or organization.

In addition to the project champion, it is crucial to determine the project developer early on. The project developer may be the local utility (public, private or cooperative) or an independent power producer. Identifying the developer will help determine what funding sources for which the project is eligible. The role of the project developer is to:

- Provide project management
- Coordinate feasibility studies and permitting
- Coordinate logistics
- Initiate and coordinate community involvement

Developing a project team of stakeholders early on will help when developing the scope and objectives. The project team will vary based on size and specifics of a project, yet it most often includes:

- Project champion
- Project developer
- Electric utility
- City or Borough government
- Tribal government
- Village corporation
- Local/regional partner organizations

## II. WIND RESOURCE & SITE SELECTION

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Identifying and securing a suitable site is absolutely essential for a successful wind project. Initially, the project team is likely to consider multiple sites until one meets all of the necessary criteria. These criteria include: *strong wind resource; wind profile; minimal wind obstacles; land ownership; meteorological studies; access to distribution and transmission lines; appropriate zoning for turbines; minimal environmental concerns; community support; subsistence/cultural resources; noise; and, geotechnical stability.*

**Strong wind resource:** Generally, a viable wind energy project has to be in an area that has a Class 4 through Class 7 wind resource. The Wind Class scale is a ranking system for quantifying the strength of the wind from Class 1 (the lowest) to Class 7 (the highest). Most of the Class 4 through 7 wind potential in Alaska is found in the western and coastal regions. Although an area may be known to have a superior wind resource, it is important to determine the site-specific resource and reliability. For some areas of Alaska, this data has already been collected by the Alaska Energy Authority's (AEA) anemometer loan program and from airport weather stations managed by the National Weather Service or Federal Aviation Administration. The AEA data are available on their website. Historic data from airport weather stations can be obtained from the National Climatic Data Center (NCDC). Considerations include:

- **Wind profile:** The wind direction, duration, velocity and variability are important considerations when assessing whether the local wind resource is suitable for development. These variables are most often measured with a meteorological tower that has sensors measuring wind speed and direction at or near the hub height of the potential wind turbine(s). Other options for getting a rough understanding of the wind resource include reviewing local wind maps and reviewing historical weather data. The local wind direction and a rough estimate of the wind strength can also be determined by the presence of "flagging" (e.g. a visual indication where the trees are deformed by the prevailing winds)
- **Minimal wind obstacles:** It is important for a site to be clear of buildings, homes, trees and other obstructions. Any obstruction has the potential to create turbulence in the air flow and cause wind shears, which will reduce the turbines performance and reliability. A common "rule of thumb" is to situate turbines at a minimum height that is three times above the tallest upwind barrier.

**Land Ownership:** It is common for a wind project to be constructed on a site that is not owned by the project developer. In many cases, a land lease or easement agreement is entered into between the landowner and the wind project developer. In Alaska, many wind projects are constructed on Native corporation land. However, other projects such as the Pillar Mountain wind farm in Kodiak are constructed on

state land. Entering into a land lease or easement will need to be discussed early on with all parties involved and must happen prior to any permitting. In addition to the actual placement of the turbines, agreements will need to be made where the land is impacted by roads, transmission lines, equipment and maintenance infrastructure. The land agreement details and compensation will vary based on the project size, scope, duration and the terms reached between the parties. Since the meteorological tower is going to be installed on the same site as the project, it is important to begin negotiating permission to use the land for project construction at the same time you get permission to install a meteorological tower.

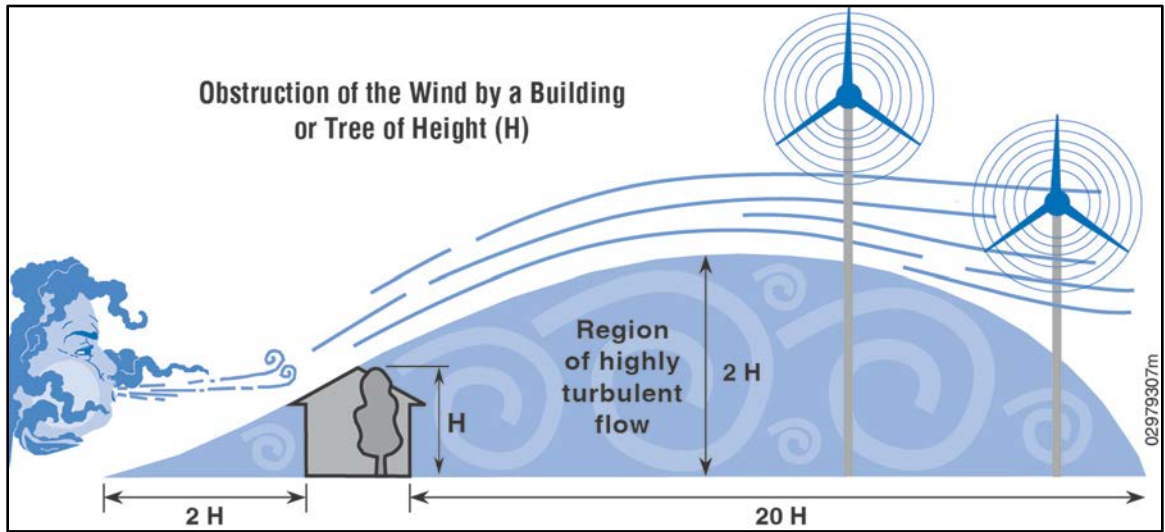


Figure 1: Wind turbines should have a minimum height three times taller than the highest upwind barrier. (Diagram courtesy of National Renewable Energy Laboratory)

**Meteorological (Met) Studies:** Once a potential site is determined, a met tower is erected in order to determine whether a site has a wind resource that is adequate for development. A met tower is typically a guy-wired, tubular tower instrumented to measure and log wind speed, wind direction, and air temperature for a specific location. Wind speed is by far the most important factor used to determine whether a wind turbine is suitable for a site. It is best to collect wind data for at least a year at a specific site in order to record the seasonal variation of the wind resource and thus provide a more precise wind model for the feasibility study. Additionally, a year's data is often required by both federal and state funding sources, such as Alaska's Renewable Energy Grant Fund and the U.S. Department of Energy.

The Alaska Energy Authority (AEA) has a Met Tower Loan Program that supplies towers, instrumentation, data logging equipment and technical support to utilities and communities interested in wind power production. The AEA assists with identifying viable sites, installing and removing the met towers, gaining federal and state authorizations for met tower placement, and analyzing data. The community's responsibilities include gaining permission from the landowner, monthly maintenance to replace data storage cards, and monitoring equipment to ensure

proper operation. Electric utilities, municipalities, Alaska Native villages, and Alaska Native Claims Settlement Act (ANSCA) corporations are eligible for the program. To find out more about the Met Tower Loan Program, contact the Alaska Energy Authority's Wind Program Director; see Appendix B for contact information.

However, just because a specific site is windy does not mean that it has an ideal wind resource that is suitable for development. There are many other factors to consider.

- **Access to distribution and transmission lines:** Significant project costs may be accrued from constructing new transmission lines and roads in order to access the project site and connect the project to existing lines. When considering a site, it is important to take into account the existing interconnection opportunities and minimize the amount of new transmission lines. You may have an ideal wind resource several miles from the community, but the intertie and road construction may end up making the project cost prohibitive.
- **Appropriate zoning for turbines:** Based on the community and land ownership, different parcels of land will have different zoning and use restrictions. Making sure that wind turbines will meet all of the zoning and use restrictions on the selected site ahead of time will speed up the permitting process. Potential zoning and use restrictions may include height limits, setbacks, spacing requirements, right-of-way easements, allowable noise levels, and compliance with various standards such as local building codes and Federal Aviation Administration (FAA) regulations. (Refer to Section V: "Permitting")
- **Minimal environmental concerns:** Environmental considerations with project construction may include the likelihood of flooding, wetland destruction, proximity to migratory bird routes and nesting grounds, and the vicinity to special-status wildlife or vegetation species. Environmental concerns, whether perceived or real, can make or break a project. (Refer to Section V: "Permitting")
- **Community support:** In order to ensure a successful project, it is beneficial to select a site that has the support of the community. This can be achieved through discussing the project site early on at community meetings and with local residents, businesses and government. Wind farms can have little to no impact on neighboring lands, but it is the responsibility of the developer to continuously work with the community to keep them and the permitting agencies informed of any changes with the project. (Refer to Section III: "Public Outreach & Community Involvement")
- **Subsistence/Cultural resources:** Consideration of subsistence and cultural resources is important for any development project in Alaska in order to minimize impacts to practices and resources. This can be achieved through working with the community to better understand significant cultural and subsistence sites and practices, as well as by designing and initiating subsistence use surveys and studies on sensitive cultural resources.

- **Noise:** Background noise from turbines can be the primary initial concern from landowners that live closest to the project site. Noise concerns may also arise if the project is located in an area that is frequented for recreational, subsistence or cultural purposes. Being sensitive to these issues and addressing them early on with landowners and the larger community will lead to a smoother planning process.
- **Geotechnical stability:** The subsurface geology and slope stability plays an important role in the foundation of wind towers. A site may have an ideal wind resource, but may be located on geologically challenging and unstable terrain that is not ideal for the project. An engineering geotechnical assessment will be required prior to foundation construction and should be done once a site is selected.

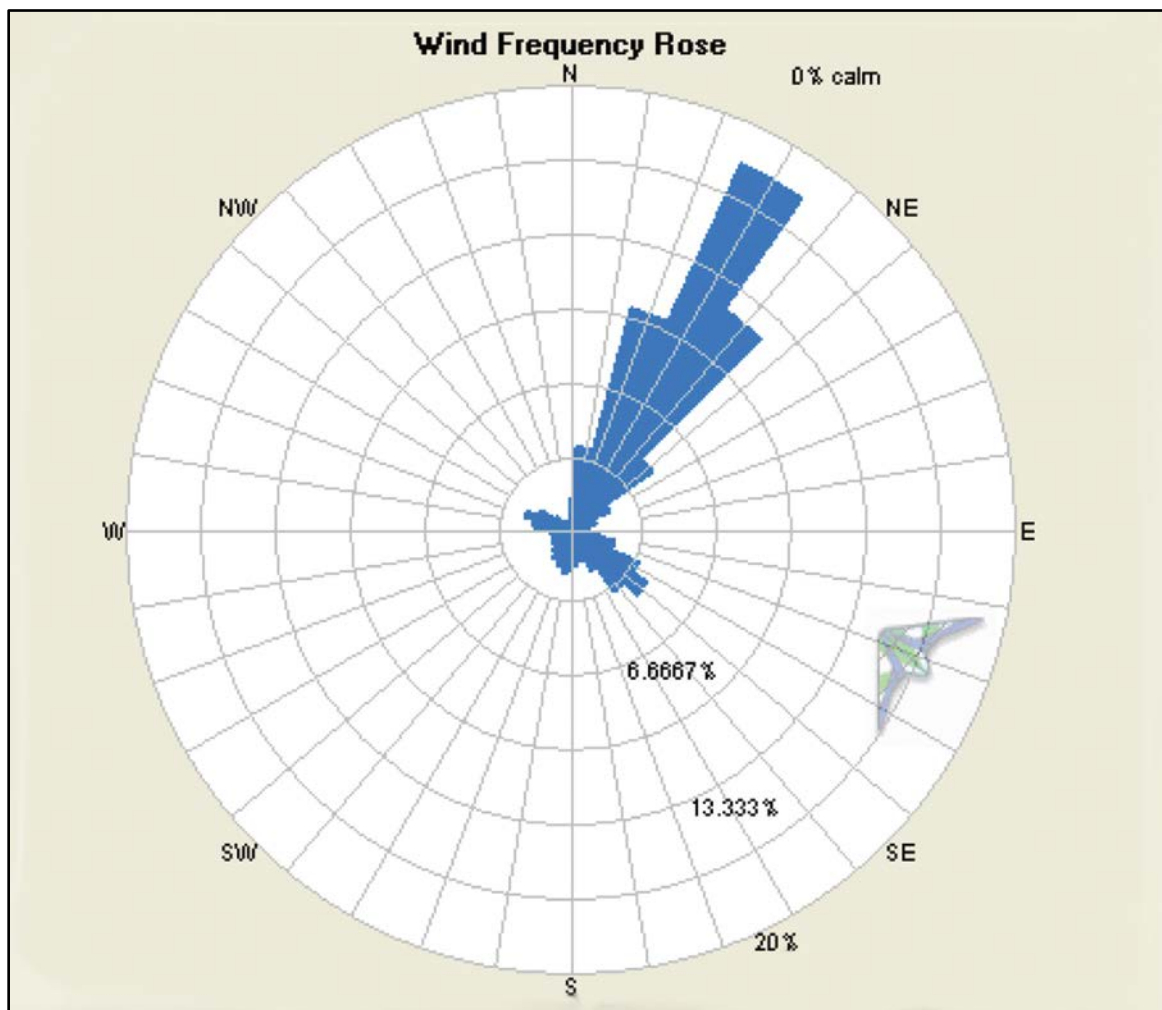


Figure 2: This wind rose, from Ambler, Alaska, shows that North-East is the primary wind direction in the area where the meteorological tower was positioned. (Diagram courtesy of Alaska Energy Authority)

### III. PUBLIC OUTREACH & COMMUNITY INVOLVEMENT

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Providing opportunities for early and meaningful public involvement during the planning, permitting and construction phases is crucial for a successful wind project. Holding community meetings, working one-on-one with landowners, and providing a period of public comment are opportune ways for project developers to both educate the community on the project and better understand community concerns. This can be a time and resource intensive process, but is necessary for providing the community with project information, addressing public concerns, and ensuring that the project is suitable for the community. Possible methods of public involvement include:

- Public forums and meetings
- Community workshops
- Formal public hearings
- Public education campaigns



Figure 3: Nome's 18 Entegriy EW-50 turbines have been producing power for the town since late 2009. Banner Wind LLC, a joint venture between Bering Straits Native Corporation and Sitnasuak Native Corporation, owns the wind farm and sells power to the Nome utility under a Power Purchase agreement contract which sets the price and requirements for operation and maintenance. (Photo courtesy Ian Graham/Western Community Energy)

## IV. WIND POWER FEASIBILITY STUDIES

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The project developer will want to ensure that the selected site and project is feasible for development prior to investing significant time, money and resources. Wind power feasibility studies examine numerous factors that help indicate whether or not a project is technically and economically feasible. These factors include but are not limited to:

- Technical feasibility studies:
  - Wind resource is available on a consistent, sustainable basis
  - Project permits and other authorizations can reasonably be obtained
  - A site is available and suitable for the proposed energy system
  - Project technical and environmental risks are reasonable
  - Proposed energy system can reliably produce and deliver energy as planned
  - Interconnection and transmission are feasible
  - Geotechnical conditions are suitable
  - Determine appropriate equipment (i.e. turbine size and suitability for climate)
- Economic feasibility studies:
  - Project is shown to be economically feasible
  - Project has an adequate financing plan
  - Examine the local cost of energy, and the comparative cost and economic benefits from an installed wind system

Wind power feasibility studies are almost always contracted out and will require anywhere from six months to two years to complete, depending on whether on-site wind data has already been collected, the size of the project, project logistics, local resources, and available funding.

## V. PERMITTING

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Securing the necessary permits is an essential step in the construction of any wind project. This phase comes after the wind resource is assessed, project economics are determined to be viable and the land acquisition is initiated, yet prior to equipment procurement and construction.

Permitting considerations may include land leases and easements, zoning, biological resources, environmental quality, visual impacts, socioeconomic issues, public safety and cultural impacts.



Figure 4: Alaska Village Electric Cooperative (AVEC) is using four Northwind 100 turbines in Chevak. In 2010, the turbines generated 16.2% of the community's electricity, saving the community 3,256 gallons of diesel fuel. (Photo courtesy of AVEC)

## A. Timeline & Planning for Permitting

It is important for the developer to analyze the potential permits that may apply to a wind project early in the planning stage. This will help to develop a comprehensive regulatory strategy that will move the project along in a timely manner.

Additionally, early identification of regulatory requirements may provide the developer with the needed time to alter project plans in order to better fit the community and project needs.

The length of time for permitting will vary from permit to permit and project to project. The timeframe for permitting will depend largely on the land ownership, land restrictions, the developer's relationship with residents and agencies, environmental regulations, logistics, and the permitting agencies. In Alaska, permitting for typical wind projects can take anywhere from two to four years once the site is selected.

## B. Who is Involved in the Permitting Process?

Due to variation in project sizes and scopes, permitting wind projects will involve numerous participants and authorities ranging from developers, landowners, agencies, utilities, Native corporations, local governments (city and tribal), borough governments, and public and other interest groups. Participants may be involved in matters pertaining to the location of the wind turbines, land ownership, existing laws and regulations, the need for transmission lines and access roads, and the size and ownership of the project.

**Local/Regional Level:** Local participants may include city councils, local utilities, tribal councils, village corporations, Boroughs, regional corporations, local interest groups and residents.

**State Level:** State involvement may include authorities from the Alaska Department of Environmental Conservation (DEC), Alaska Department of Natural Resources (DNR), Alaska State Historic Preservation Office (SHPO), Regulatory Commission of Alaska (RCA), and Alaska Department of Transportation (DOT). These participants may be involved in permitting for environmental quality and protection, historic preservation, and electricity regulations.

**Federal Level:** Federal permitting authorities may include federal land management agencies (e.g. Bureau of Land Management, U.S. Forest Service), U.S. Fish and Wildlife Services, Environmental Protection Agency, the Federal Aviation Administration, U.S. Army Corps of Engineers and the Bureau of Indian Affairs.

## C. Issues Addressed Through Permitting

- Land Use
- Land Access
- Noise
- Navigable Air Space
- Subsistence & Cultural Impacts
- Biological Resources
- Visual Impact
- Wetland Disturbance
- Water Quality
- Public Health & Safety

*Note: Not every consideration will apply to all wind projects*

**Land Use:** Project developers must work closely with all of the stakeholders in order to fully understand the range of land use issues associated with the selected project site prior to advancements in the planning and permitting process. In addition to finding a site that has good wind potential, the developer must coordinate with agencies, utilities, landowners, and the public, as well as review existing land use plans and policies. This helps ensure that the developers are in compliance with existing land uses and regulations.

The amount of land designated for wind development will vary based on the size of the project and the local terrain. Only a small area of the actual project site is needed for the turbines and foundations. (For example, the foundation for each turbine in Unalakleet covers 21 square feet). However, additional infrastructure such as roads, transmission lines and maintenance facilities will require a larger land area. This will all be determined as the project planning progresses.

**Land Access:** It is important to know the landowners, land restrictions and the required permits early in the planning process. It is required that all landowners, both private and public, give permission for the use of their land for any development projects, whether through a lease, direct purchase, or negotiation of a right-of-way easement. If the land is leased, landowners have the right to determine the specific use of the property, location of the project, and any reclamation that must occur once the turbines are decommissioned. Land use may include roads, transmission lines, wind turbines, foundations, facilities and maintenance equipment. Right-of-way easements are often needed for transmission lines and roads and land owners should be justly compensated. All of this should be discussed at length prior to permitting.

**Noise:** Noise concerns can become an issue due to increased levels of background noise and will likely only affect landowners closest to the wind turbine site. For the most part, the noise created by the wind turbines is minimal and masked by the

noise of the wind itself. However, it still may arise as a potential problem and the issue should be addressed early on by talking to landowners nearest the project site, raising the issue at community meetings and having the community actively involved in the project site selection.

**Navigable Air Space:** Impact to navigable airspace or aviation communications/navigation infrastructure is a concern with almost any wind energy development. In an effort to reduce hazards, regulations require that turbines and towers be a specific distance away from public airstrips and telecommunication equipment. Regulations also require towers and turbines to have lights installed so they can be seen from the air during the day and night. Such regulations are overseen by the Federal Aviation Administration (FAA) and should be addressed early on.



Figure 5: Although wind turbine construction has relatively low impact compared to conventional energy development, potential impacts must be evaluated. Subsistence and cultural impacts must be considered along with land use, land access, noise, navigable air space, visual impact, biological resources, wetland disturbance, water quality and public health and safety. (Unalakleet photo courtesy of STG Inc.)

**Subsistence & Cultural Impacts:** Subsistence hunting and fishing are incredibly important for many individuals, communities and cultures across Alaska. Specific to wind energy development, potentially affected subsistence resources may include migratory birds, caribou, moose and berries and may be affected by roads, turbines, noise and changes to the habitat. It is important to conduct relevant surveys, and talk to local residents, local government officials and tribes early on in the planning process and prior to permitting.

**Biological Resources (*Like Birds*):** The potential impact to birds from wind turbines has been a controversial issue and is often raised throughout the permitting process. Alaska provides very important habitat for waterfowl and migratory birds and both their flight paths and nesting areas should be thoroughly researched when selecting a project site. Biological resource surveys and talking with local residents can help to determine whether or not serious conflicts are likely to occur. In most cases, biologically significant impacts on birds are unlikely to occur, or can be adequately mitigated. However, if proper mitigation is not possible, a new site may need to be located for the particular wind development.

The risk of birds and bats colliding with wind turbines will vary based on the size and number of turbines, as well as the species of birds in the local area. Although this concern is greatest with large-scale projects, as opposed to the smaller projects that are being developed in Alaska, it is still a valid concern and must be addressed with any project. Such concerns are most frequently addressed by site-specific monitoring. Such avian monitoring may determine:

- Bird use and flight patterns near proposed sites
- Different species that frequent a site
- Flight altitude of the bird species
- Specific times of a year that birds frequent an area

Multiple studies have been conducted by Alaska Biological Research, Inc. (ABR), local utilities, and developers throughout Alaska. These studies have included bird migration, power line collision, tower collision, and wind power studies. The study sites have included Mekoryuk, Hooper Bay, Gambell, and other locations in Southcentral, Interior, and Northern Alaska. Such studies provide a useful baseline to begin determining whether a specific site has a potential avian issue; however, site-specific monitoring must be a part of any wind power project.

The simplest method of avian monitoring is visual, including the use of binoculars, spotlights, night vision optics, and thermal imaging devices. Such monitoring may involve hiring local residents and utilizing their local knowledge about a specific site. To learn more about avian monitoring, contact ABR (See Appendix for ABR contact information).

**Visual Impact:** Visual obstructions can often be the most common community issue that arises with wind energy development due to the turbine height, location and

color of the turbine blades. There are a number of ways to reduce the visual impact of wind projects, such as considering the site location and proximity to the community, houses and commonly used spaces. However, there are often tradeoffs and the farther the project site is from the community and existing transmission lines, the greater the project costs are due to new transmission lines and roads. Part of the mitigation process for visual impacts may be to consider and document the following types of questions:

- To what extent are the turbines visible?
- Does the visibility change with season or time of the day?
- Which residents and businesses see the turbines?
- To what extent does the visibility of the turbines alter the character and quality of the environment and community?
- How are visual impacts addressed by policies and the community?

**Wetland Disturbance:** Although wind turbine construction has relatively low impact compared to conventional energy development, there are inevitable impacts, and, in Alaska, it often results in disturbance to wetland habitat. Wetlands in Alaska make up approximately 65% of the state's land area and include bogs, muskegs, marshes, swamps and mud flats. With wind energy development, wetland loss largely results from road construction and wind turbine foundations. The U.S. Army Corps of Engineers is the primary agency that permits development which will discharge dredged or fill material into waters, including wetlands.

**Water Quality:** Though not a common concern, certain wind projects have the potential to impact the water quality of nearby waterways and are therefore subject to the Clean Water Act. Based on the size (disturbing more than five acres) and project site, wind projects must obtain a National Pollution Discharge Elimination System (NPDES) permit and develop a Storm Water Pollution Prevention Plan. These measures are to ensure that water pollution and discharge is monitored in order to protect waterways and reduce erosion.

**Public Health and Safety:** Public health and safety issues associated with wind projects differ from other forms of energy development due to the lack of a combustible fuel source, fuel storage, and the generation of toxic materials. However, wind projects do involve electrical infrastructure, transmission lines and equipment operation, and like other development and operations, must address safety issues. This is done through inspections by the utilities, reviews by engineers and working with state and local regulations in the permitting phase.

Additionally, due to the extreme cold weather in Alaska, wind development is also subject to unique safety concerns, such as ice throw. This is due to the accumulation of ice on the blades, nacelle, and tower and can result in ice being thrown from the turbine instead of dropping straight down. Design features, altering turbine operation during icing events, and establishing setback safety zones around the turbines, can be implemented to minimize ice throw and improve safety.

## D. Federal Permits & Processes

The federal government's involvement in wind power development is limited to wind projects that are either constructed on federal lands or that trigger some level of federal involvement. In Alaska, most projects are situated on Native or private lands and have limited involvement from the federal government due to siting. However, projects that receive federal funding from the U.S. Department of Energy (DOE) or U.S. Department of Agriculture require specific permits and are subject to certain regulations. Federal permits are also based on the project size and impact, but the primary federal land permits and policies are listed in Table 1

## E. State Permits

In Alaska, several state agencies have authority over permitting for development projects on state land. Specific agencies and departments may include the Alaska Department of Environmental Conservation (DEC), State Historic Preservation Office (SHPO), Regulatory Commission of Alaska (RCA) and the Department of Transportation (DOT). Even if development is not on state land, the wind project may be subject to state permits in addition to the local or federal permit.

This list of federal and state permits and consultations is not complete. For a more complete list, refer to Alaska Wind Energy Development: Best Practices Guide to Environmental Permitting and Consultation at:

[www.akenergyauthority.org/Reports%20and%20Presentations/2009WindBestPracticesGuide.pdf](http://www.akenergyauthority.org/Reports%20and%20Presentations/2009WindBestPracticesGuide.pdf)

## F. Local Land Policy

**Tribal/City/Borough Land:** Local authorities are likely to have a local planning commission, city council, tribal council or zoning board that has jurisdiction over regulations and permitting land use on city, tribal and borough land. Be sure to contact these local entities to determine what, if any, permits are needed. However, if there are not formal regulations, the developer should continue to work closely with the local entity that owns the land through all stages of the project. Possible permits include:

- Setbacks
- Building codes
- Zoning restrictions (e.g. height restrictions)

**Table 1: Typical Federal Permits Required for Wind Energy Projects**

REGULATION/ PERMIT	PERMITTING AGENCY	PERMIT DESCRIPTION	WHEN IS THE PERMIT REQUIRED?
National Environmental Policy Act	Varies depending on the lead agency (based on land jurisdiction)	Mandate to review environmental impacts of proposed actions and development	<ul style="list-style-type: none"> <li>Project is sited on federal lands</li> <li>Need to access federally owned transmission line</li> <li>Any funding from federal grants</li> </ul>
Federal Special Use Permits and Rights of Way (ROWS)	Varies based on land jurisdiction (BLM, USDA, BIA, USFWS)	Required when a project is developed on federal lands	<ul style="list-style-type: none"> <li>When federal land is used for siting turbines, transmission lines and access roads for a wind project</li> </ul>
Notice of Proposed Construction (Form 7461-1) Hazard Determination	Federal Aviation Administration (FAA)	Requires a safe distance, markings and lighting on structures affecting a navigable air space	<ul style="list-style-type: none"> <li>Construction of structures higher than 200 feet above ground level</li> <li>Tower is within 20,000 feet of a public-use airport with a runway more than 3,200 feet long</li> <li>Siting within radar line-of-sight of an air defense facility</li> </ul>
Endangered Species Act (Consultation & Incidental Take Permit)	U.S. Fish & Wildlife Service	Regulates activities affecting threatened & endangered species and establishes federal interagency consultation	<ul style="list-style-type: none"> <li>Activities that may result in take or harm to species and their habitat, such as site clearing, construction and turbine operation</li> </ul>
Bald and Golden Eagle Protection Act (Consultation & Take permit)	U.S. Fish & Wildlife Service	Prohibits harm, possession, or take of bald and golden eagles	<ul style="list-style-type: none"> <li>Potential impact to bald or golden eagle</li> <li>Necessity for moving golden eagle nest</li> </ul>
Migratory Bird Treaty (Consultation)	U.S. Fish & Wildlife Service	Prohibits harm, possession, or take of migratory bird species, nests, and eggs	<ul style="list-style-type: none"> <li>Potential impact to migratory bird species protected by the act</li> </ul>
National Historic Preservation Act (Section 106 Consultation)	Advisory Council on Historic Preservation, Tribal Historic Preservation Office	Reviews impacts to historic and Tribal resources	<ul style="list-style-type: none"> <li>Activity may impact property listed in or eligible for listing in the National Register of Historic Places</li> <li>Activity may impact Tribal resources</li> </ul>
Clean Water Act: Section 402 (National Pollution Discharge Elimination System Permit)	Environmental Protection Agency	Regulates discharges into waters of the U.S. ( <i>State of Alaska currently in process of gaining primacy over permitting</i> )	<ul style="list-style-type: none"> <li>Potential for discharge from site, construction and operation</li> </ul>
Clean Water Act: Section 404	U.S. Army Corps of Engineers	Regulates discharge of dredged or fill materials into U.S. waterways	<ul style="list-style-type: none"> <li>Activities that may impact federal waters, including wetlands</li> </ul>

**Table 2: Typical State Permits Required for Wind Energy Development:**

REGULATION/ PERMIT	PERMITTING AGENCY	PERMIT DESCRIPTION	WHEN IS THE PERMIT REQUIRED?
<b>Fish &amp; Essential Fish Habitat</b>	Alaska Department of Fish & Game	Stipulates mitigation measures when wind projects impact fish and essential fish habitat	When access roads and transmission lines cross fish- bearing waterways
<b>Cultural, Historic, and Archaeological Resource Consultation/ Studies/Permits</b>	State Historic Preservation Office	Potential impacts to cultural resources	Identified potential for development to disturb, alter or impact cultural resources
<b>Alaska Coastal Management Program</b>	Alaska Department of Natural Resources	Evaluated projects within the Coastal Zone for consistency with statewide standards and local coastal district enforceable policies	For projects within a Coastal Zone area (up to 200 miles inland)
<b>Land Use, Easements and Right-of-Ways</b>	Alaska Department of Transportation	For wind projects that are occurring on or crossing state lands	If proposed road and transmission line corridors would be on airport property or along roadways on property managed by the DOT

## G. Private Land Policy

**Native Allotment Land:** Native allotments are private individual land parcels that are held in trust by the federal government. Although they are owned by the individual, they are subject to certain regulations due to their trust status. When considering using a Native allotment as the site for a wind project, the developer will need to work with both the land owner and the land's service provider, which is likely be the Bureau of Indian Affairs, regional service provider or the local Tribe. Certain regulations are likely to include the:

- National Environmental Policy Act (NEPA)
- National Historic Preservation Act, Section 106 (Consultation)

**Native Corporation Land:** Village and Regional Native Corporations are entities established under the Alaska Native Claims Settlement Act (ANCSA) and are considered private land holdings. If a potential wind resource is identified on Village or Regional Native Corporation land, those entities should be contacted directly.

**Other Private Land:** Project developers will need to work directly with private landowners in order to come to an agreement for the use of the land for wind development or access.

## VI. FINANCING

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Financing a wind project is a significant undertaking and requires careful planning. Projects can bring considerable economic benefits to the community, but they will also have substantial upfront costs for the developer, whether they be a utility, local government or other entity. Determining the finances for a wind project will also help determine whether or not a project is feasible. These costs may include:

- **Machinery, equipment, and material:** Turbines, blades, towers, foundations, transmission lines, collection systems, communication and control systems
- **Studies:** Feasibility studies, output projections, interconnection studies, capacity and flow analysis
- **Loan:** Interest rate and terms of agreement
- **Others:** Interconnection fees, system upgrades, operation & maintenance, personnel, operator

Financing options will vary based on who the project developer is and can be a combination of options. The local Native corporation or participating government should be able to assist in the process of finding the available finance options for the community.

**Power Purchase Agreement:** A crucial step of financing any wind energy project is to set up a Power Purchasing Agreement (PPA). The PPA determines the rate at which the utility provider will purchase the energy if it is produced by another entity, as well as other obligations between the project and utility. PPAs can take a significant amount of time to negotiate, but are essential components of any wind project because they secure the long-term flow of revenue resulting from the sale of energy.

**Power Cost Equalization (PCE):** Wind projects can impact a community's PCE funding. The impact on PCE funding is a consideration when determining whether to install energy systems in rural Alaska. However, a discussion of the impact on PCE is outside the scope of this document. More information on the impact on PCE can be found in the 2010 report "*Isolated Wind Diesel Systems in Alaska*" by the Institute of Social and Economic Research and Alaska Center for Energy and Power:

[www.iser.uaa.alaska.edu/presentations/wind.pdf](http://www.iser.uaa.alaska.edu/presentations/wind.pdf)

### A. Grants & Loans

**State Financing:** The State of Alaska provides numerous financing options for energy projects, and the options for renewable energy projects are growing. Table 3 lists some of the grants and loans that are currently available.

**Table 3: State of Alaska Grants and Loans for Wind Energy Development**

TYPE OF LOAN OR GRANT	ISSUER	DESCRIPTION	CONTACT
<b>Renewable Energy Grant Fund</b>	Alaska Energy Authority (AEA)	One of the largest sources of funding for state renewable energy projects.	Alaska Energy Authority Tel. (907) 771-3000 E-mail: re_fund@aidea.org
<b>Power Project Loan Fund</b>	AEA	Funding for future state energy projects; provides loans to local utilities, local governments, or independent power producers.	Leona Hakala, Loan Officer Tel. (907) 771-3032 Fax (907) 771-3044 E-mail: lhakala@aidea.org
<b>Rural Development Initiative Fund</b>	Alaska Division of Investments	Fund offers loans for up to \$100,000/person or up to \$200,000 for 2 or more people.	Alaska Division of Investments, Dept. of Commerce, Community, and Economic Development Tel. (907) 465-2510 (907) 478-LOAN TDD (907) 465-5437 E-mail: investments@ak.gov

**Federal financing:** If a wind energy project qualifies for federal funding, the following finance options, among others, may be available.

**Table 4: Federal Funding Options for Wind Energy Development**

TYPE OF GRANT OR LOAN	ISSUER	DESCRIPTION	CONTACT
<b>Clean Renewable Energy Bonds (CREBs)</b>	Internal Revenue Service	These bonds act as tax credit bonds, with the bondholder receiving a federal tax credit covering 70% of the interest on the bond.	IRS Office of Associate Chief Counsel (202) 622-3980
<b>Rural Energy for America Program</b>	U.S. Department of Agriculture	Provides grants for up to \$250,000 and loan guarantees up to \$25 million.	USDA Business and Energy Programs Specialist (907) 761-7718 E-mail: chad.stovall@ak.usda.gov
<b>National Renewable Energy Laboratory (NREL) Tribal Energy</b>	U.S. Department of Energy	The budget for this fund averages \$5 million a year and could be used for feasibility studies, construction, and technical assistance, among other possibilities.	Alaska: Brian Hirsch, Senior Project Leader-AK (907) 271-3633. E-mail: brian.hirsch@nrel.gov  National: Lizana Pierce Project Manager (303) 275-4727 E-mail: lizana.pierce@go.doe.gov

The Denali Commission also could be a possible source of funding for the Energy Planning component of a wind project. This could include grants for business planning, community and regional planning, conceptual design, and feasibility studies. For example, AVTEC received a \$500,000 grant from the Denali Commission to purchase and install a 100kW wind turbine at its' Seward campus for wind technician training. For more information on possible Energy Planning grants, see Appendix B for Denali Commission contact information.

**Private Financing:** There is also the possibility of private financing for a wind energy project, although this is less likely in Alaska, due to the smaller scale of wind energy projects and the abundance of government-funded finance options.

**Tax Incentives:** Besides grants and loans, there are several tax incentives for renewable energy projects that are worth exploring. It is important to remember that these, like the various loans and grants offered, may change from year to year. The following three options are currently offered through the IRS.

- **Renewable Electricity Production Tax Credit (PTC):** The PTC is an income tax credit for the production of electricity from qualified wind energy facilities and other sources of renewable energy. The current value of the credit is 2.2 cents/kilowatt-hour of electricity produced. This generally applies to the first 10 years of operation. The credit is only available to systems where construction began prior to December 31, 2011. The production tax credit (PTC) is only applicable to utility-scale wind turbines, not smaller turbines used to power individual homes or businesses.
- **Business Energy Investment Tax Credit (ITC):** The ITC is a single federal tax credit for 30% of the total up-front capital cost of a wind project. Note: a taxpayer cannot take both a PTC and an ITC for a facility that qualifies for both; one or the other must be chosen.
- **Modified Accelerated Cost Recovery System (MACRS):** Allows for federal tax deductions based on the depreciation of tangible property.

## VII. SYSTEM DESIGN

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System design is a crucial component of developing a viable and appropriately constructed wind system. Wind system design components include the turbine size, turbine type, number of turbines, type of controls, battery storage, smart grid technology, secondary loads, and the wind penetration. All of these variables will need to be considered when developing any wind project. In addition, communities need to consider the impact of wind power on existing diesel engines that supply power. These hybrid systems, known as wind-diesel systems, are the standard in rural Alaska. Designers will need to take into account variables such as the power output and responsiveness of the diesel engines to ensure they work in tandem with the wind turbines.

**Size:** Utility-scale wind turbines and wind farms come in various sizes, depending on the electric demand, application, local wind resource and available financing. In Alaska, projects range in size from a few hundred kilowatt (kW) systems, such as in Kasigluk and Savoonga, to the 4.5 megawatt (MW) system installed in 2009 in Kodiak.

Another aspect of sizing is whether to install more, smaller turbines or fewer large turbines. The benefits of installing larger turbines may come from the reduced upfront costs resulting from larger turbines often being less expensive per kW of installed capacity. There is also the potential to spend less money on labor since fewer turbines will be installed. The reduction in labor is often countered by more expensive equipment needed to install larger units. The benefit of installing multiple smaller turbines comes from being able to have multiple turbines operational while others are down for maintenance and repairs. Determining the size of your turbines and overall wind farm is essential before moving forward with any further design or construction.

**Penetration:** Wind penetration refers to the amount of electrical energy that is supplied by the wind turbines compared to the total amount of electrical demand. For example, Kasigluk generated 23% of its total electricity in 2009 from wind turbines. The remaining electricity was generated by diesel engines. (See Case Study #1 for more details).

**Control Systems:** Control systems are a vital element of a wind project, particularly with medium and high penetration systems. Control systems coordinate the operation of all components of the generation system. Control systems must be able to maintain power quality on the grid by balancing electrical supply and demand. As more variable wind generation is included in the generation mix, more complex systems are needed to maintain this balance.

**Swept Area:** The swept area is the area through which the rotor blades of a wind turbine spin, and is directly related to the power output. The larger the diameter of the turbine blades, the more power the turbine is able to harness. Swept area is a very important consideration when deciding what type of turbine to purchase.

**Table 5: Wind Penetration Class and Operational Characteristics**

PENETRATION CLASS	OPERATIONAL CHARACTERISTICS	AVERAGE ANNUAL PENETRATION	EXAMPLE
Low	<ul style="list-style-type: none"> <li>• Diesel generator(s) run full-time</li> <li>• Wind power reduces net load on diesel</li> <li>• No supervisory control system</li> </ul>	<20%	Kotzebue, Nome
Medium	<ul style="list-style-type: none"> <li>• Diesel generator(s) run full-time</li> <li>• At high wind power levels, secondary loads are dispatched to ensure sufficient balance of wind and diesel system</li> <li>• Requires relatively simple control systems</li> </ul>	20%-50%	Kasigluk, Toksook Bay
High	<ul style="list-style-type: none"> <li>• Diesel(s) may be shut down during periods of high wind</li> <li>• Requires sophisticated control systems</li> </ul>	50%-150% * *  *Can be over 100% if excess wind is used for heating (thermal load).	St. Paul Island

*Based on System Penetration Table from NREL (Ian Baring-Gould)*

**Equipment Procurement:** Every wind project will have different needs and require different design features from a turbine. Some machines are designed to operate more efficiently at lower wind speeds while others are intended for more robust wind regimes. Having in-depth knowledge of the local wind profile and how the specific characteristics of a site will affect a turbine's performance and lifespan will help in deciding what equipment is best suited for a specific project. A developer should compare their project's estimated performance to the actual performance of existing machines in other areas.

Once the type of turbine suitable for your project is identified, it is important to also consider the price and availability. Due to increasing demands for developing wind resources, there are often long waiting lists for many wind turbines, towers and transformers, so it is important to plan as far in advance as possible. It is also beneficial to talk with other wind developers in your area to learn about their experiences working with various manufacturers.

**Compatibility of Components:** For wind-diesel systems, it is important that the system components are compatible. This includes considering both the diesel generator and the wind turbine. The age, quality and size of the diesel generator must be considered, as well as the type, size, and performance of the wind turbine.



Figure 7: Black blades resist frost build-up and help minimize the potential hazard of “ice throw” from a turbine. (Quinhagak photo courtesy of Alaska Village Electric Cooperative)

## VIII. CONSTRUCTION & INTERCONNECTION

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Once the wind system is designed and the financing is secured, the developer can focus on the construction and electric interconnection. This work will most likely be subcontracted to a construction company, but will vary depending on the developer. Wind farm construction involves everything from building roads and transmission lines, digging trenches for underground electric cables, to laying the foundations and erecting the turbines. Almost all of the construction requires the use of heavy equipment and a specialized workforce.

Interconnection of the wind system with the current system is a fundamental step during construction. This requires that the existing or new transmission lines are capable of carrying the additional electric load supplied by the turbines and that the connection has been designed and built with the appropriate levels of protection to maintain the safety of those who work on the grid. The interconnection design will have been previously determined by an interconnection study and negotiated in an interconnection agreement with the utility.



Figure 8: Subsurface geology plays an important role in siting the foundation of a wind tower. An ideal site must have both a good wind resource and suitable terrain, as illustrated by this project in Delta Junction. (Photo courtesy of Mike Craft/ Alaska Environmental Power)

## IX. OPERATION & MAINTENANCE

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Operations & Maintenance (O&M) is a major component of maintaining a reliable wind project and must be carried out throughout the project's lifespan, which can be 20 years or more. Proper and regular maintenance of wind turbines and systems can prove to be invaluable and is often provided through contract maintenance and by local operators. Turbine manufacturers often offer training for local operators, as well as provide their own contracted maintenance.

In addition to the physical maintenance on the wind project, O&M costs may also include warranties, insurance, administrative fees and payments to landowners for the development to and access of their land.

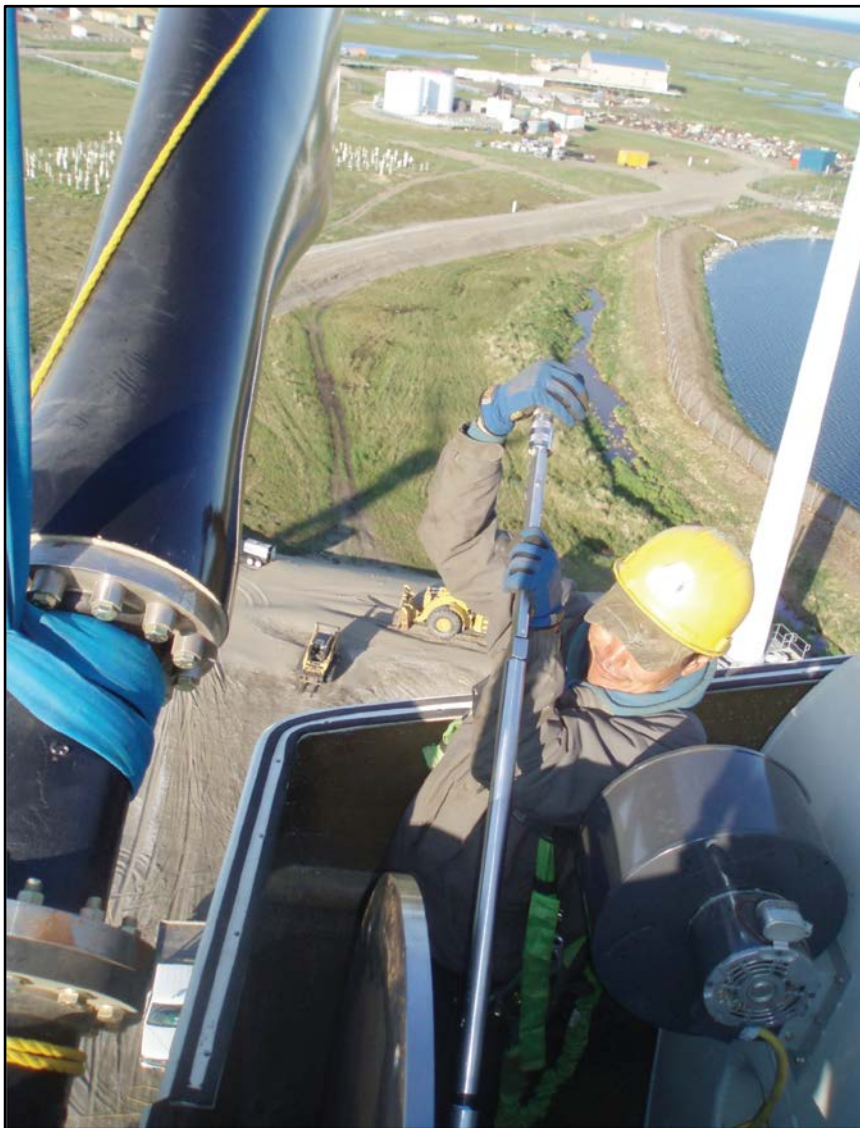


Figure 9: A Wind Technician adjusts the rotor assembly during installation of the NW100 wind turbines in Hooper Bay, Alaska. (Photo courtesy of Alaska Village Electric Cooperative)

## X. CASE STUDIES

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### **KASIGLUK, ALASKA**

**Location:** Kasigluk is located on the Johnson River in the Yukon-Kuskokwim River Delta region, 26 miles northwest of Bethel. The project serves the residents of Kasigluk, Nunapitchuk and Akula Heights.

**Project Developer:** Alaska Village Electric Cooperative (AVEC) is a non-profit electric utility serving 53 villages throughout Interior and Western Alaska.

**Wind Class:** Class 4-5

**Project timeframe:** The project planning began in 2002 and the turbines were on-line and producing electricity in 2006.

**Energy champion:** Brent Petrie, Project Manager, Alaska Village Electric Cooperative

**Project Overview:** The wind generation project was part of a larger AVEC project constructed at Akula Heights, which provided electric service to three communities. The turbine installation piggybacked on the relocation of the bulk fuel systems, moving the backup generator from Akula Heights to Nunapitchuk, building a new main power plant in Akula Heights, and upgrading the 3-mile intertie between the Nunapitchuk, Kasigluk and Akula Heights. The bulk fuel system was relocated due to boggy and shifting ground at the old site. The intertie had to be upgraded due to deteriorating power line foundations, which added a year to the overall project. The project involved multiple contractors that provided services including construction management, project design, and turbine foundation.

**Local Cooperating Organizations:** Participants in the project included AVEC, Kasigluk Traditional Council, Kasigluk Incorporated, City of Nunapitchuk and the Lower Kuskokwim School District.

**Project Site:** The project is sited on land leased from Kasigluk, Incorporated, the local Native corporation.

**Permitting:** Permits were required from the Federation Aviation Administration, Army Corps of Engineers, and U.S. Fish and Wildlife Service. Very few, if any, concerns emerged from the communities throughout the permitting process. The primary concerns resulted from conditions placed on the project through the National Environmental Policy Act (NEPA) process and by the federal permitting agencies.



Figure 10: The Northwind 100 turbines installed in Kasigluk, Alaska, use a direct drive system with minimal moveable parts. They have an enclosed nacelle that makes maintenance possible in severe temperatures and climates. The blades are black and coated with a substance that limits frost and ice build-up. (Photo courtesy of Alaska Village Electric Cooperative)

**Turbine Type and Specs:** Three Northern Power Systems' Northwind 100 kW turbines were installed. The Northwind100 turbines are a direct drive system with minimal moveable parts. They have an enclosed nacelle that makes maintenance possible in severe temperatures and climates. The blades are black and coated with a substance that limits frost and ice build-up. The system was built with a recovered heat system that transfers excess energy into a dump load thermal tank to heat the community center and eventually the water treatment plant.

**Generating Capacity of Turbines:** 300 kW

**Turbine Supplier:** Northern Power Systems Inc.

**Operation/Maintenance:** Scheduled maintenance occurs on the turbines every six months, both before and after the windy season. There is a maintenance service agreement between AVEC and Northern Power Systems. Unscheduled maintenance also occurs and is carried out by the local operator. Kasigluk regularly has two to three on-site operators that monitor the system up to four times a day through the use of Supervisory Control and Data Acquisition (SCADA) system, a computerized web-based system that provides a graphical interface to monitor and control the turbines. SCADA is also accessed by AVEC and Northern Power Systems and allows the turbines to be started and stopped remotely. AVEC provided on-site training for its operators. Some operators also received training from the Alaska Vocational Technical Center and vendor training through Northern Power Systems.

**Lessons learned:** The use of an amalgamated approach allowed for the construction of multiple projects simultaneously, resulting in cost savings and the ability to maximize various resources at the same time. For example, a crane was shipped onsite and used for multiple projects rather than being shipped in and out of the village for different projects constructed at different times. AVEC also learned that it was best to do most of the heavy equipment work (e.g. pile driving for foundations) during the winter when the ground was frozen in order to minimize impact to the environment.

**Power Generation:** 551,371 net kWh from wind in 2010.

**Savings:** 40,592 gallons of diesel fuel were offset by the wind generation in 2010. The wind turbine supplied 20.2% of the net total production of electricity to the communities.

**Cost:** The total project cost was \$3,271,439.

**Funding:** 10% of the project funding came from AVEC and 90% came from the Denali Commission.

**Important Consideration:** Crane rental and the need for a quick turn around on equipment rentals.

## **KODIAK, ALASKA**

**Location:** Kodiak Island is located in the Gulf of Alaska approximately 300 miles southwest of Anchorage.

**Project Developer:** Kodiak Electric Association (KEA) is a generation, transmission and distribution electric cooperative serving the City of Kodiak, Chiniak, Pasagshak, and the Port Lions area. KEA also serves the United States Coast Guard Base.



Figure 11: Kodiak is now able to generate 89% of its electricity from renewable resources – 80% from hydropower and 9% from wind. (Photo courtesy of Jim Jager/CIRI)

**Wind Class:** Class 7

**Project Timeframe:** Wind studies began in August of 2005 and the project was completed in July 2009.

**Energy Champion:** Darron Scott, President/CEO, Kodiak Electric Association, Inc.

**Project Overview:** The project has three 1.5 megawatt (MW) GE wind turbines for a total of 4.5 MWs. These were the first large-scale (over 1 MW) wind turbines in the state and the goal is to work in unison with the Terror Lake Hydroelectric Plant. The project has provided 9% of the utility's annual power system needs. It generated

approximately 13.3 million kWh's in its first year of operation, and saved more than 900,000 gallons of diesel that year.

**Local Cooperating Organizations:** Kodiak Island Borough, City of Kodiak, U.S. Coast Guard Base, numerous local contractors, the entire KEA membership, Kodiak Audubon Society, Sustainable Kodiak, Kodiak Chamber of Commerce.

**Project Site:** Located on a ridgeline atop Pillar Mountain, approximately 1,200 ft above sea level.

**Permitting:** Permits were required from Federal Aviation Administration, Kodiak Island Borough, City of Kodiak, State of Alaska, U.S. Army Corps of Engineers, Alaska Department of Transportation & Public Facilities. The entire community supported this project and no concerns were noted throughout the permitting process.

**Turbine Type and Specs:** Three 1.5 MW GE SLE turbines with a hub height of 262 feet, nacelle weight of 124,000 lbs, rotor diameter of 252 feet. Startup wind speed of 7 mph and a shutdown wind speed of 57 mph

**Generating capacity of turbines:** 4.5 MW

**Turbine Supplier:** General Electric

**Operation/Maintenance:** KEA has a two-pronged approach to its current operation and maintenance plan. KEA has trained two employees by sending them to an extensive GE Wind Turbine School. The technicians are trained at the level of Commission Technicians and can provide on-island expertise which will benefit the cooperative in the long term operation and maintenance of the wind turbines. The technicians handle the trouble shooting and minor maintenance. They also work with GE on the semiannual and annual maintenance requirements. For the first year of operation, the turbines have operated very well and maintenance requirements have been minimal.

**Lessons Learned:** For construction, KEA learned quite a bit about the logistics and planning required to install large scale wind turbines. In order to keep costs under control, significant planning is required. For operation, they have done significant control and system work to integrate wind and hydro together on an isolated grid.

**Power Generation:** 12.2 million kWh annually was expected. July 3, 2010 marked the first year of operation. Total production for the first year was 13,294,653 kWh – greatly exceeding expectations.

**Savings:** The turbines provide approximately 9% of Kodiak's annual energy needs, supplementing the Terror Lake hydroelectric facility. The first year of operation saved the cooperative membership from purchasing 936,243 gallons of diesel fuel for generation needs.

**Cost:** The overall project cost was approximately \$21 million.

**Funding:** KEA received a total of \$4 million in renewable energy grant funds from the Alaska Energy Authority, which was matched with \$1 million from KEA. KEA also applied for and received \$12 million in Clean Renewable Energy Bonds (CREBs) from the IRS. CREBs funding was provided through Co-Bank, a cooperative bank that funds rural utilities. Co-Bank provided KEA a 0.85% interest rate for these bonds.

**Important Considerations:** "Planning and integration are key for a successful project."

## APPENDICIES

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### A. TOOLKIT SOURCE MATERIALS:

The following information and websites were used when compiling this information:

**Alaska Energy Authority (AEA)**

*Renewable Energy Atlas of Alaska:*

Resource for policy makers, advocates, land owners, developers, utility companies, and others interested in renewable energy production in Alaska.

[www.akenergyauthority.org](http://www.akenergyauthority.org)

**Alaska Energy Authority (AEA)**

*Best Practice Guide to Environmental Permitting & Consultation:* Focuses on assisting rural Alaska communities navigate through the permitting processes for small wind energy development projects.

[www.akenergyauthority.org/Reports%20and%20Presentations/2009WindBestPracticesGuide.pdf](http://www.akenergyauthority.org/Reports%20and%20Presentations/2009WindBestPracticesGuide.pdf)

**American Wind Energy Association (AWEA)**

*FAQ for Small Wind*

[www.awea.org/documents/factsheets/Small\\_Wind\\_FAQ\\_Factsheet.pdf](http://www.awea.org/documents/factsheets/Small_Wind_FAQ_Factsheet.pdf)

*Wind Energy Siting Handbook:*

Information about environmental siting issues relevant to land-based commercial-scale wind energy project development.

[www.awea.org/sitinghandbook/](http://www.awea.org/sitinghandbook/)

*Small Wind Toolbox:* Information about zoning and permitting procedures

[www.archive.awea.org/smallwind/toolbox/default.asp](http://www.archive.awea.org/smallwind/toolbox/default.asp)

**Database of State Incentives for Renewables and Efficiency (DSIRE)**

Comprehensive source of information on state, local, utility and federal incentives and policies that promote renewable energy and energy efficiency.

[www.dsire.org](http://www.dsire.org)

**Distributed Generation Systems, Inc**

*The Wind Project Development Process:* Overview of the specific steps that are required to plan, design, construct, and operate a typical wind project.

[www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/wind\\_development\\_process.pdf](http://www.eere.energy.gov/windandhydro/windpoweringamerica/pdfs/wind_development_process.pdf)

**Iowa Energy Center**

*Wind Energy Manual:* Information on issues and considerations related to wind energy development

[www.energy.iastate.edu/Renewable/wind/wem-index.htm](http://www.energy.iastate.edu/Renewable/wind/wem-index.htm)

**Massachusetts Technology Collaboration**

*Air Space Issues in Wind Turbine Siting:* Explains how the FAA review process works, and how to anticipate and avoid potential roadblocks.

[www.masscec.com/masscec/file/Airspace%20Issues%20Page\\_Final.pdf](http://www.masscec.com/masscec/file/Airspace%20Issues%20Page_Final.pdf)

**National Wind Coordinating Committee (NWCC)**

*Permitting of Wind Energy Facilities*

*Handbook:* Provides detailed information in what to expect in the permitting process

[www.nationalwind.org/assets/publications/permitting2002.pdf](http://www.nationalwind.org/assets/publications/permitting2002.pdf)

**New York State Energy Resource and Development Authority (NYSERDA)**

*Wind Energy Toolkit:* Outlines phases of wind project planning.

[www.powernaturally.org/programs/wind/toolkit.asp](http://www.powernaturally.org/programs/wind/toolkit.asp)

**Wind Powering America (WPA)**

*Wind Energy for Rural Economic*

*Development:* Discusses economic development basics, economic security, challenges, relationship with rural areas, and specific impacts, including job creation, property taxes, and landowner revenues.

[www.windpoweringamerica.gov/filter\\_detail.asp?itemid=1246](http://www.windpoweringamerica.gov/filter_detail.asp?itemid=1246)

## B. ADDITIONAL USEFUL AGENCIES & ORGANIZATIONS

### STATE:

**Alaska Audubon Society**

441 West 5th Avenue  
Anchorage, AK 99501-2309  
(907) 276-7034  
[ak.audubon.org/](http://ak.audubon.org/)

**Alaska Energy Authority, Renewable Energy Fund Grants Administrator**

Butch White  
(907) 771-3048  
E-mail: [re\\_fund@aidea.org](mailto:re_fund@aidea.org)

**Alaska Center for Energy and Power (ACEP)**

**University of Alaska Fairbanks**  
PO Box 755910  
Fairbanks, AK 99775-5910  
(907) 474-5402  
[www.uaf.edu/acep](http://www.uaf.edu/acep)

**Alaska Village Electric Cooperative (AVEC)**

4831 Eagle St.  
Anchorage, Alaska, 99503  
(907) 561-1818  
[www.avec.org/](http://www.avec.org/)

**ABR, Inc.**

P.O. Box 80410  
Fairbanks, Alaska 99708  
(907) 455-6777

**Denali Commission**

510 L Street, Suite 410  
Anchorage, AK 99501  
(907) 271-1414  
[www.denali.gov](http://www.denali.gov)

**Alaska Energy Authority (AEA)**

813 West Northern Lights Boulevard  
Anchorage, AK 99503  
(907) 771-3000  
Toll Free (in Alaska): (888) 300-8534  
[www.aidea.org/aea/](http://www.aidea.org/aea/)

**Renewable Energy Alaska Project**

308 G Street, Suite 207  
Anchorage, Alaska 99501  
(907) 929-7770  
[www.REalaska.org/](http://www.REalaska.org/)

**Alaska Energy Authority, Wind Program**

James Jensen  
(907) 771-3043  
E-mail: [jjensen@aidea.org](mailto:jjensen@aidea.org)

**FEDERAL:**

**American Wind Energy Association (AWEA)**

1501 M Street, NW, Suite 1000

Washington, DC 20005

(202) 383-2500

[www.awea.org](http://www.awea.org)

E-mail: [windmail@awea.org](mailto:windmail@awea.org)

**American Council on Renewable Energy (ACORE)**

1600 K Street NW, Suite 700

Washington D.C. 20006

(202) 393-0001

[www.acore.org](http://www.acore.org)

E-mail: [info@acore.org](mailto:info@acore.org)

**Federal Aviation Administration (FAA)**

800 Independence Avenue, SW

Washington, DC 20591

1-866-835-5322

[www.faa.gov](http://www.faa.gov)

**National Renewable Energy Laboratory (NREL)**

1617 Cole Blvd.

Golden, CO 80401-3305

(303) 275-3000

[www.nrel.gov](http://www.nrel.gov)

[www.windpoweringamerica.gov](http://www.windpoweringamerica.gov)

**US Dept. of Agriculture (USDA)**

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(907) 761-7718

E-mail: [chad.stovall@ak.usda.gov](mailto:chad.stovall@ak.usda.gov)

**U.S. Department of Energy (DOE)**

**Energy Efficiency and Renewable Energy**

(202) 586-5000

[www.eere.energy.gov](http://www.eere.energy.gov)

**U.S. National Climatic Data Center**

151 Patton Avenue

Asheville NC 28801-5001

(828)-271-4800

[www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

## **C. PERMITTING AGENCY CONTACT INFORMATION:**

### **Alaska Department of Environmental Conservation (ADEC)**

555 Cordova Street  
Anchorage, AK 99501  
(907) 269-7599

[www.dec.state.ak.us/water](http://www.dec.state.ak.us/water)

Re: Clean Water Act Section 402: National Pollution Discharge Elimination System Permit

### **Alaska Department of Fish and Game (ADF&G)**

Habitat Division  
(907) 267-2172 (Anchorage Regional Office)  
(907) 459-7289 (Fairbanks Regional Office)

[www.habitat.adfg.alaska.gov](http://www.habitat.adfg.alaska.gov)

Re: Fish and Essential Habitat

### **Alaska Department of Natural Resources (ADNR)**

Division of Coastal and Ocean Management  
(907) 269-7470 (Anchorage)  
(907) 465-3562 (Juneau)

[www.alaskacoast.state.ak.us](http://www.alaskacoast.state.ak.us)

Re: Alaska Coastal Management Program, Public Information Center to determine land ownership

### **Alaska Department of Transportation (ADOT)**

3132 Channel Drive  
PO Box 112500  
Juneau, AK 99811-2500  
(907) 465-3900

[www.dot.state.ak.us/](http://www.dot.state.ak.us/)

Re: Land use, easements, right-of-ways

### **U.S. Army Corps of Engineers (USACE)**

Alaska Regulatory District  
(800)-478-2712

[www.poa.usace.army.mil/reg/](http://www.poa.usace.army.mil/reg/)

Re: Clean Water Act Section 404 (wetlands and other waterways)

### **Alaska Office of History and Archeology: Department of Natural Resources**

Office of History and Archaeology  
550 W. 7th Ave. Suite 1310  
Anchorage AK 99501-3565  
(907) 269-8721

[www.dnr.state.ak.us/parks/oha/](http://www.dnr.state.ak.us/parks/oha/)

E-mail: oha@alaska.net

Re: Cultural, historic, and archaeological resource consultation/studies/permits

**Bureau of Indian Affairs (BIA)**

Juneau Area Office

P.O. Box 25520

Juneau, AK 99802

(907) 586-7177

[www.bia.gov/WhoWeAre/RegionalOffices/Alaska/index.htm](http://www.bia.gov/WhoWeAre/RegionalOffices/Alaska/index.htm)

Re: Federal Special Use Permits and Right-of-Ways (ROWS)

**Bureau of Land Management (BLM)**

222 West 7<sup>th</sup> Ave.

Anchorage, AK 99513

(907) 271-5960

[www.blm.gov/ak/st/en.html](http://www.blm.gov/ak/st/en.html)

Re: Federal Special Use Permits and ROWS

**Environmental Protection Agency (EPA) Region X**

1200 Sixth Avenue

Seattle, WA 98101

(800)-424-4372, ext. 6650

[www.epa.gov/region10](http://www.epa.gov/region10)

Re: Clean Water Act Section 402: National Pollution Discharge Elimination System Permit,  
National Environmental Policy Act

**Federal Aviation Administration (FAA)**

Alaska Region

222 West 7<sup>th</sup> Ave

Anchorage, AK 99512

(907) 271-5438

[www.faa.gov](http://www.faa.gov)

Re: Aviation safety, hazard determination

**Fish & Wildlife Service (USFWS)**

Anchorage Field Office

1011 E. Tudor Road #200

Anchorage, AK 99503

(907) 786-3309

[www.alaska.fws.gov](http://www.alaska.fws.gov)

Re: Migratory Bird Treaty Act, Endangered Species Act, bird collision issues, Federal Special  
Use Permits and Rights-of-Ways (ROWS)

## D. GLOSSARY

**Anemometer:** A device used to measure wind velocity as part of a wind resource assessment study. The anemometer typically is installed on a guy-wired tilt-up tower at the anticipated location and height of the potential wind turbine.

**Battery:** An energy storage device made up of one or more electrolyte cells.

**Blade or Rotor:** Part of the wind turbine that converts the energy in the wind to rotational shaft energy.

**Clean Renewable Energy Bond (CREB):** CREBs are a special type of tax credit bond providing rural electric cooperatives, municipal electric utilities, and government entities (including tribal councils) the equivalent of an interest-free loan for financing qualified energy projects.

**Commercial Scale Wind:** Refers to wind energy projects greater than 100 kW where the electricity is sold rather than used on-site.

**Electricity:** The flow of electrical power or charge. We get electricity from the conversion of other sources of energy, including coal, gas, wind and solar.

**Electricity Generation:** The process of producing electric energy or the amount of electric energy produced by transforming other forms of energy, commonly expressed in kilowatt-hours (kWh) or megawatt-hours (MWh).

**Electric Grid:** A network of power lines used to move energy from its source to consumers.

**Energy:** The ability to do work or the ability to move an object. Electrical energy is usually measured in kilowatt-hours (kWh), while heat energy is usually measured in British thermal units (Btu).

**Energy Efficiency:** Refers to activities that are aimed at reducing the energy used by substituting technically more advanced equipment, typically without affecting the services provided.

**Energy Conservation:** A reduction in energy use achieved through a change in behavior (e.g. turning down the thermostat or turning off lights in one's home).

**Intermittent:** The wind does not blow all of the time and does not always blow during the times of the day when electricity is needed.

**Kilowatt-Hour (kWh):** A unit of energy equal to 1,000 watt-hours. This is the basic measure of electric energy generation or use. A 100-watt light bulb that is left on for 10 hours uses one kilowatt-hour.

**Load:** The amount of electric power drawn at a specific time from an electric system, or the total power drawn from the system. Peak load is the amount of power drawn at the time of highest electrical demand.

**Nacelle:** The nacelle is a large housing that sits atop the tower behind the rotor. It houses the main mechanical components of the wind turbine: the drive train, gearbox, transformer and generator.

**Power:** The rate at which energy is transferred. Electrical energy is usually measured in watts. Also used for a measurement of capacity.

**Production Tax Credit:** Provides the owner of a qualifying facility with an annual tax credit based on the amount of electricity that is generated. By focusing on the energy produced instead of capital invested, this type of tax incentive encourages projects that perform adequately.

**Supervisory Control and Data Acquisition (SCADA) system:** A computerized monitoring system that connects the individual turbines, substation and meteorological stations to a central computer. It allows the wind project operator to supervise the turbines and control power output. It also records energy output, availability and error signals.

**Set back:** A term used in siting and permitting for the construction of structures, set back refers to the distance from the base of the structure to existing easements, roads, buildings, bodies of water, or other geographic or man-made structures or property lines.

**Transmission Line:** A set of conductors, insulators, supporting structures, and associated equipment used to move large quantities of power at high voltage, usually over long distances between a generating or receiving point and major substations or delivery points.

**Wind:** A form of solar energy caused by the uneven heating of the atmosphere by the sun, rotation of the earth and irregularities of the earth's surface.

**Wind Farm:** Wind turbines that are grouped together into a single wind power plant to generate electric power. Electricity from wind farms is fed into the electric grid and distributed to consumers.

**Wind Power Class:** A way of quantifying on a scale the strength of the wind at a project site. The Department of Energy's National Renewable Energy Laboratory defines the wind class at a site on a scale from 1 to 7 (1 being low and 7 being high)

based on average wind speed and power density to offer guidance to potential developers as to where wind projects might be feasible.

**Wind Shear:** A term and calculation used to describe how wind speed increases with height above the surface of the earth. The degree of wind shear is a factor of the complexity of the terrain as well as the actual heights measured. Wind shear increases as friction between the wind and the ground becomes greater. Wind shear is not a measure of the wind speed at a site.

**Wind Tower:** Devices, typically at least 100 feet tall, which lift wind turbine blades high above the ground to catch stronger wind currents.

**Wind Turbine:** A device with blades that is turned by the force of wind. The mechanical energy of the spinning turbine is converted into electricity by a generator.

Cover photo of St. Paul Island courtesy of TDX Power.  
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